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Cover Photo:
RSV *Nuyina* crossing the southern Indian Ocean on 2 October on her way to her home port of Hobart
(Photo courtesy Australian Antarctic Division)

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RSV *Nuyina*

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New Construction, Marine & Offshore Rotterdam, Lloyd's Register

Introduction

While much has been said and written about the new polar ship *Nuyina,* and much more will be heard about her missions and achievements in the years to come, this paper aims to provide a brief insight to mark her first arrival in her home port. She arrived in Hobart, Tasmania on 16 October 2021 after a 47-day 12 958 n mile voyage from the historical fishing port of Vlissingen (Flushing in English) in the North Sea. *Nuyina* will be replacing the retired *Aurora Australis* which had served Australian Antarctic Division (AAD) for more than 30 years.

Her Naming

Her name was proposed by Australian schoolchildren through a 'Name our Icebreaker' competition. The word Nuyina, pronounced as "noy-yee-nah", means 'Southern Lights' in palawa kani the language spoken by Tasmanian Aborigines. The name signifies the long connection that Tasmanian Aboriginal people have with the southern lights, or in other words with aurora australis.

Her Birth

The official delivery of the Australian Antarctic Division's icebreaking Research and Supply Vessel (RSV) *Nuyina* took place three months earlier in the port of Vlissingen on 28 August 2021. Her journey from design, to construction, and commissioning at Damen Schelde Naval Shipbuilding (DSNS) was not free from challenges and took more than five years, see Table 1. Not to mention the preceding five years of contemplation and planning at the government's desk. Her naval architectural design was undertaken by Knud E. Hansen, a Danish-based leading independent consultancy with a portfolio of more than 800 ships built to their design since 1937.

She is designed to accommodate and deploy a wide range of vehicles from land, sea and air including helicopters, landing barges and amphibious trucks to support diverse operations. A unique feature to the vessel is her hybrid propulsion system which can support both the high power needed for icebreaking as well as the silent running for scientific operations. In terms of seakeeping she can handle:

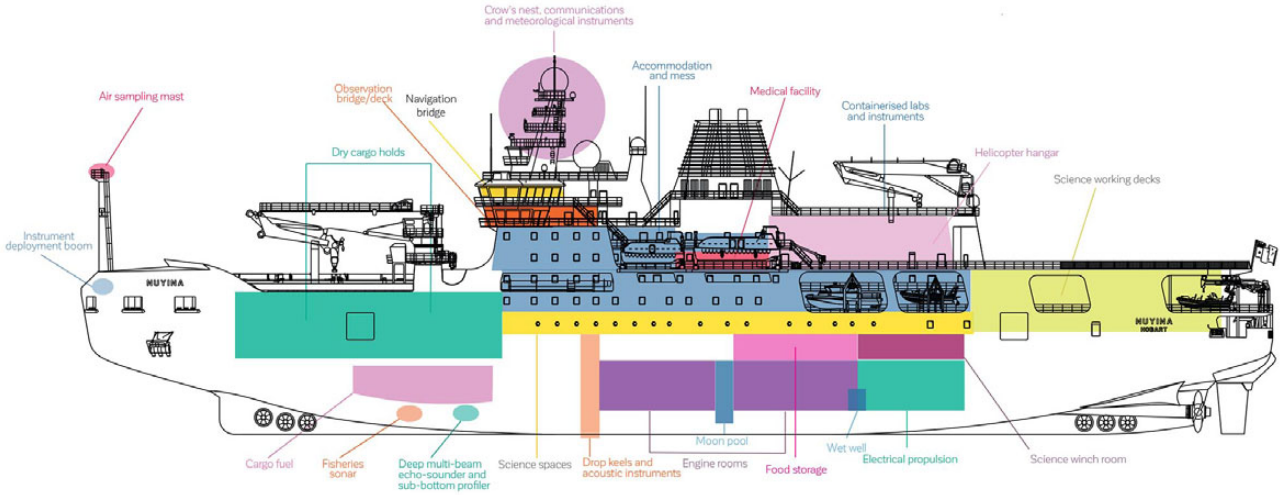
- waves up to sea state 9 (14 m plus significant wave height)
- wind speed up to Beaufort 12 (hurricane)

Table 1 — Key dates and Milestones

Construction contract	28 Apr. 2016
Steel cutting	31 May 2017
Keel-laying	24 Aug.2017
Launching	17 Sep.2018
Harbour Acceptance Tests	May 2019
Classification	17 Aug.2021
Arrival Hobart	16 Oct. 2021

- air temperatures ranging from −30° C to 45° C, and
- water temperatures ranging from −2° C to 32° C

While the construction of the hull and installation of machinery was successfully completed at Damen's Galati shipyard in Romania, by mid-2020 the global outbreak of the COVID-19 pandemic was taking its toll on the progress of this project. At the outfitting stage, given the need to mobilise equipment suppliers and technicians from various parts of the world, to speed up the process it was decided to relocate her to Damen's main shipyard site in Vlissingen the Netherlands. Vlissingen, due to proximity to two major European ports (Rotterdam at 130 km and Antwerp at 86 km), has a strategic and favourable position in this regard (see Figure 1). The 3672 n mile relocation journey, though a justified plan, its achievement was not easy as she had to pass many obstacles through the Black Sea, the Mediterranean and Strait of Gibraltar under tow. During towage through the Sulina channel on the Danube River in August 2020, her body lightly touched the ground. Consequently, on arrival in the Netherlands, she underwent thorough diver inspections followed by dry docking to ensure any scratch to the hull paint was identified and reinstated.



Profile of *Nuyina* showing the arrangement of facilities and equipment
(Drawing courtesy Australian Antarctic Division)

Figure 1 Vlissingen is between two major EU ports

Monday morning 26 November 2020 was the *moment of truth* for her as she set sail for her first technical sea trials in the deep waters of the North Sea. More than 100 people, men and women including a medical doctor, accompanied her during this voyage. One prominent observation which caught the attention of those onboard was her silence and smoothness in various navigation and manoeuvring modes in comparison to other ships which they had experienced previously. Upon completion of three weeks of technical sea trials she headed towards Norwegian waters for the second part of trials to test and calibrate the scientific and environmental equipment capabilities. She returned to the Netherlands right before Christmas to recuperate and undergo further fine-tuning.

The push and need for delivery of *Nuyina* heightened as the news of a debilitating fire onboard MPV *Everest* broke out in April 2021. Such urgency demanded an intensified support and presence of the Australian team in the Netherlands. With the Australian government's COVID lockdown measures in place the supervising team of AAD and SERCO crew visiting the Netherlands had to additionally bear the burden of quarantine on each flight returning home. Accordingly, a word of appreciation to their families and loved ones for their patience and support during this period is genuinely deserved.

Alongside the many players engaged in the battle with COVID restrictions, the Australian Maritime Safety Authority (AMSA) as the flag administration devoted profound remote support to guarantee a timely delivery by holding frequent online meetings and review of progress reports. Finally, by 17 August 2021 *Nuyina* proved to be deserving of registration and the issue of the required certificates. Achieving this goal was an exciting moment of success for all parties including Lloyd's Register (LR) as her classification society and certifying body on AMSA's behalf. "I am sure that when *Nuyina* reaches her home it will be a very exciting and historical moment for the crew and the Australian nation. We wish *Nuyina* and her crew calm seas and decades of safe operation and important research work," read part of LR CEO Nick Brown's letter on this occasion. According to LR ship classification rules, *Nuyina* has earned a number of remarkable notations* as indicated in Table 2 which makes her an outstandingly prestigious ship in her own right.

Table 2 — Class Notations

Classification	|100A1 Research/Supply Ship, Icebreaker(+), Helideck, LA, *IWS, LI, Winterisation H(-40), D(-30), S(B), Ice Class PC3
Environmental	ECO (BIO, BWT, EnMS, GW, IBTS, IHM, NOx-2, OW, P, SEEMP, Sox)
Machinery	|LMC, CAC2, UMS, DP(AA), NAV1, IBS, PSMR*
Descriptive notes	ShipRight [ES(anti heeling and anti roll tanks +1 mm for plating and internal stiffening), SCM, SERS]

As an example the PSMR* notation denotes that the main propulsion and steering systems are configured such that, in the event of a single failure in equipment, the ship will retain not less than 50 per cent of the installed prime mover capacity and not less than 50 per cent of the installed propulsion systems and retain steering capability. The propulsion and steering arrangements are installed in separate compartments so that, in the event of the loss of one compartment, the ship will retain availability of propulsion power and manoeuvring capability. *Nuyina's* propulsion system comprises diesel-driven main engines as well as electric motors and combinations thereof, all controlled through a smart Power Management System (PMS) for the various modes of sailing and icebreaking. Figure 2 illustrates the redundancy in her propulsion arrangement — not to mention her steering and dynamic positioning capabilities featuring six thrusters and a pair of controllable pitch propellers.

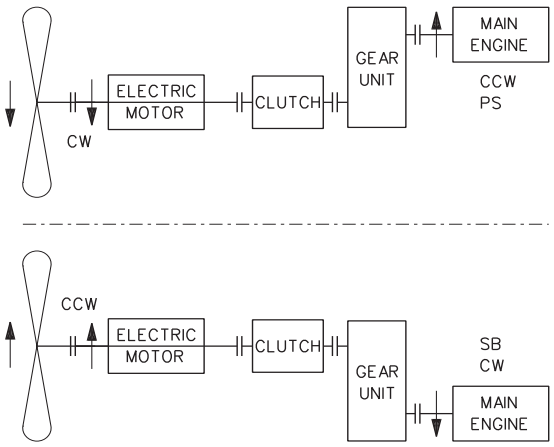


Figure 2 Propulsion layout
(Drawing courtesy DSNS)

If one wants to appreciate such a ship's function and mission, the author recommends reading about Captain Shackleton's crew and their ship *Endurance*. *Nuyina,* as a descendant of *Endurance*, is a unique investment and inspiring ship in many aspects. Her seakeeping, icebreaking, logistical and technical capabilities make her the right platform for future polar scientific explorations in the Antarctic. Assimilating and squeezing such diverse elements all within a 160 m body of steel posed many big challenges to the builder and the owner. For instance, halfway through the design process it was realised that if she is to accommodate all the desired equipment then her mighty steel body needed to be further lengthened by almost 5 m! If one is interested to get a relative idea of *Nuyina* with respect to one of her age-sake relatives such as RRS *Sir David Attenborough* see Table 3.

Table 3 — Main features of RSV *Nuyina* and RRS *Sir David Attenborough* (Wikipedia)

	RSV *Nuyina*	**RRS *Sir David Attenborough***
Owner	DMS Maritime Pty Limited	NERC Research Ship Unit
Builder	Damen Schelde Naval Shipyards	Cammell Laird
Home port/Flag	Hobart/Australia	Stanley, Falkland Islands
IMO Number	9797060	9798222
Cost million	$A528	£GB200
Start Construction	24 August 2017	17 October 2016
Classed/Acquired	17 August 2021	2 December 2020
Length m	160.3	129
Breadth m	25.6	24
Draught m	9.3	7
Tonnage/DWT	25 500	15 000
Ice class	Polar class 3 icebreaker (+)	Polar class 4 (hull) 5 (machinery)
Endurance days	90	60
Propulsion	2 × 9600 kW	2 × 2750 kW
Speed max. knots	16+ (3 knots in ice 1.65 m thickness)	17.5
Crew	32 crew, 116 scientists + 1 doctor	28 crew; 60 scientists; 2 spare berths
Collectible Stamps		

State-of-the-art Scientific Equipment:

Nuyina will be the backbone of Australia's Antarctic program over the next 30 years by providing a wide range of logistical and scientific exploration capabilities. She will serve as the main lifeline to Australia's three Antarctic research stations and its sub-Antarctic station on Macquarie Island. She has a number of flexible modular science laboratories and is the only ship in the world to have a watertight room or 'wet well' to process seawater for krill and other fragile marine organisms, at up to 1800 L per minute. Other scientific equipment includes acoustic instruments to map and visualise the seabed and organisms in the water column, and instruments to measure atmospheric gases, cloud properties, wave heights and ice conditions. An overview of the scientific equipment and sensor suites is presented in Table 4.

Table 4 — Overview of Scientific Equipment and Sensor Suite

Science Equipment	**Sensor Suite**
500 m² science laboratories and offices	Deep water wide-band bathymetric echo-sounder
24 × modular science containers	High resolution multi-beam bathymetric echo-sounder
8 m stern A-frame, Modular deep-sea coring system	Sub-bottom profiler
Towing booms and winches, Trawling system (winches and net drums)	Acoustic Doppler Current Profiler
2 × drop keels	Mammal observation hydrophones
CTD system, Moon pool handling system	Fishery sonar system
Wet well and ultra-pure seawater systems	Weather doppler radar and BOM Sensors
Meteorological and air chemistry labs	Ultra-short Base Line (USBL)
Forward deployment boom	Expendable Bathythermograph (XBT) probe system
	Conductivity Temperature and Depth system (CTD)

Her Arrival and Future

As *Nuyina* emerged on the horizon in Hobart a COVID-lockdown in Tasmania held back her spectators at a distance and she showed her appreciation by blowing the whistle a number of times and making a magnificent 360° turn in the bay.

"We are excited to arrive in Hobart and finish the long

Nuyina arriving in her home port of Hobart
(Photo courtesy Australian Antarctic Division)